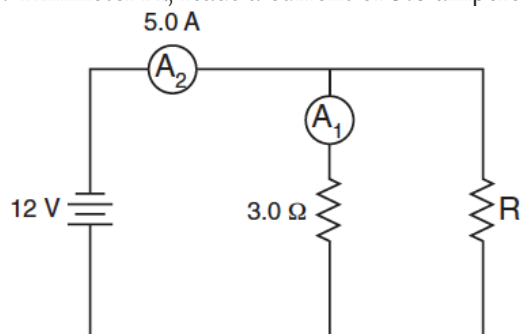Name: _____   Period: _____

Circuits-Circuit Analysis

Base your answers to questions 1 through 3 on the information and diagram below.

A 3.0-ohm resistor, an unknown resistor, R, and two ammeters, A_1 and A_2, are connected as shown with a 12-volt source. Ammeter A_2 reads a current of 5.0 amperes.

1. Determine the equivalent resistance of the circuit.

2. Calculate the current measured by ammeter A_1. [Show all work, including the equation and substitution with units.

3. Calculate the resistance of the unknown resistor, R. [Show all work, including the equation and substitution with units.]

4. A 9-volt battery is connected to a 4-ohm resistor and a 5-ohm resistor as shown in the diagram below.
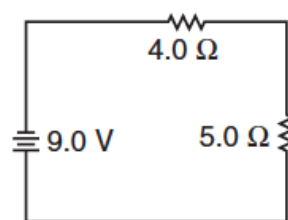
What is the current in the 5-ohm resistor?
1. 1.0 A
2. 1.8 A
3. 2.3 A
4. 4.0 A

Base your answers to questions 5 through 7 on the information below.

An 18-ohm resistor and a 36-ohm resistor are connected in parallel with a 24-volt battery. A single ammeter is placed in the circuit to read its total current.
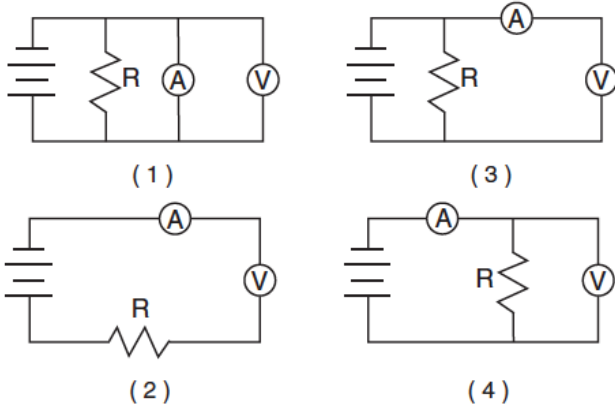
5. Draw a diagram of this circuit.

6. Calculate the equivalent resistance of the circuit.

7. Calculate the total power dissipated in the circuit.

Circuits-Circuit Analysis

8. In which circuit would current flow through resistor R1 but not through resistor R2 while switch S is open?

(1)   (2)   (3)   (4)

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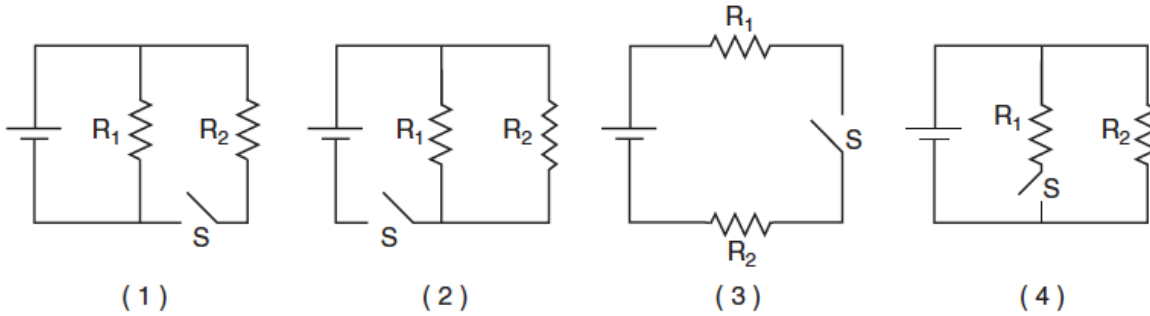
9. Which circuit diagram below correctly shows the connection of ammeter A and voltmeter V to measure the current through and potential difference across resistor R?


(1)   (3)

(2)   (4)

10. In the space below, draw a diagram of an operating circuit that includes:
    *   a battery as a source of potential difference
    *   two resistors in parallel with each other
    *   an ammeter that reads the total current in the circuit

Base your answers to questions 11 through 13 on the information and diagram below.

A 15-ohm resistor, R_1, and a 30-ohm resistor, R_2, are to be connected in parallel between points A and B in a circuit containing a 90-volt battery.

90. V
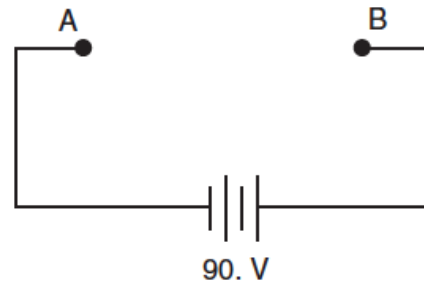
11. Complete the diagram above to show the two resistors in parallel between points A and B.

12. Determine the potential difference across resistor R_1.

13. Calculate the current in resistor R_1.

Circuits-Circuit Analysis

Base your answers to questions 14 through 16 on the information and diagram below, showing all work including the equation and substitution with units.

A 50-ohm resistor, an unknown resistor R, a 120-volt source, and an ammeter are connected in a complete circuit. The ammeter reads 0.50 ampere.
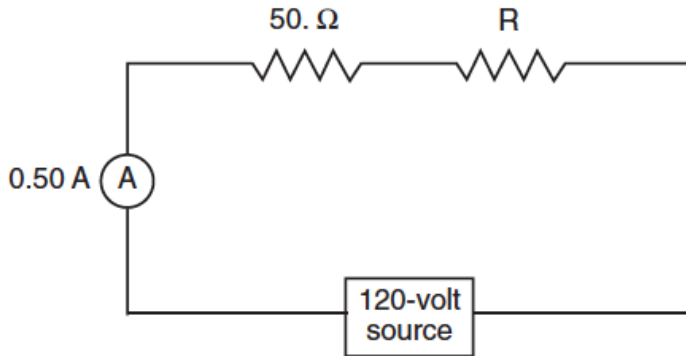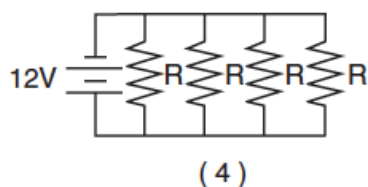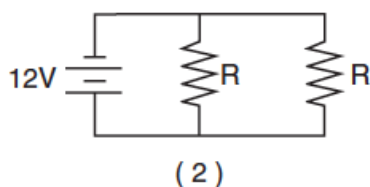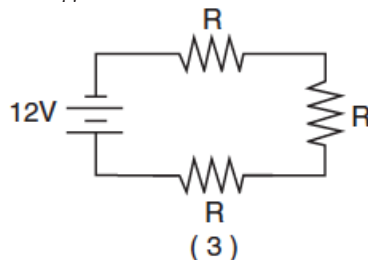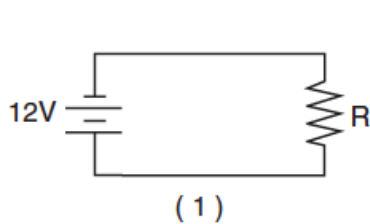

14. Calculate the equivalent resistance of the circuit.

15. Determine the resistance of resistor R.

16. Calculate the power dissipated by the 50-ohm resistor.

17. In which circuit would an ammeter show the greatest total current?
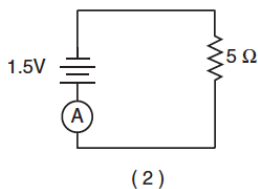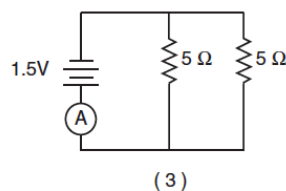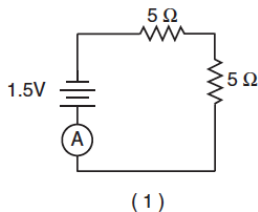
Circuits-Circuit Analysis

Base your answers to questions 18 through 22 on the information below and data table at right.

Three lamps were connected in a circuit with a battery of constant potential. The current, potential difference, and resistance for each lamp are listed in the data table. [There is negligible resistance in the wires and battery.]

	Current (A)	Potential Difference (V)	Resistance (Ω)
lamp 1	0.45	40.1	89
lamp 2	0.11	40.1	365
lamp 3	0.28	40.1	143

18. Using standard circuit symbols, draw a circuit showing how the lamps and battery are connected.

19. What is the potential difference supplied by the battery?

20. Calculate the equivalent resistance of the circuit.

21. If lamp 3 is removed from the circuit, what would be the value of the potential difference across lamp 1 after lamp 3 is removed?

22. If lamp 3 is removed from the circuit, what would be the value of the current in lamp 2 after lamp 3 is removed?

23. In which circuit would ammeter A show the greatest current?
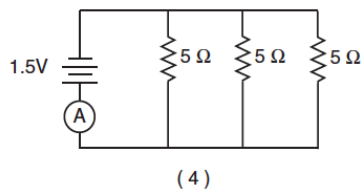
Circuits-Circuit Analysis

24. A 6-ohm resistor and a 4-ohm resistor are connected in series with a 6-volt battery in an operating electric circuit. A voltmeter is connected to measure the potential difference across the 6-ohm resistor. Draw a diagram of this circuit including the battery, resistors, and voltmeter. Label each resistor with its value.

25. What is the total current in a circuit consisting of six operating 100-watt lamps connected in parallel to a 120-volt source?
    1. 5 A
    2. 20 A
    3. 600 A
    4. 12,000 A

26. The circuit diagram below represents four resistors connected to a 12-volt source.

    $R_1 = 4.0\ \Omega$ $R_2 = 6.0\ \Omega$

    12 V $R_3 = 8.0\ \Omega$

 $R_4 = 6.0\ \Omega$
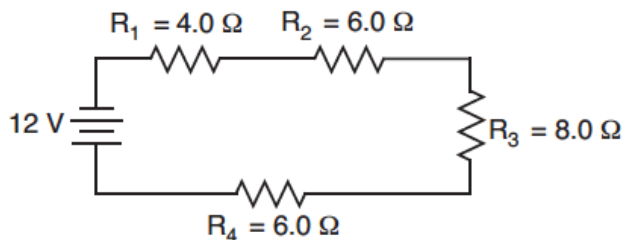
    What is the total current in the circuit?
    1. 0.50 A
    2. 2.0 A
    3. 8.6 A
    4. 24 A

27. As the number of resistors in a parallel circuit is increased, what happens to the equivalent resistance of the circuit and total current in the circuit?
    1. Both equivalent resistance and total current decrease.
    2. Both equivalent resistance and total current increase.
    3. Equivalent resistance decreases and total current increases.
    4. Equivalent resistance increases and total current decreases.

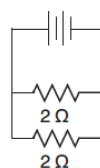Base your answers to questions 28 and 29 on the circuit diagram below.

A   24-V source $R_1 = 4.0\ \Omega$ $R_2 = 12\ \Omega$ S_1
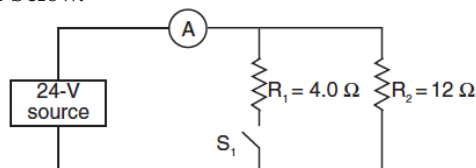
28. If switch S_1 is open, the reading of ammeter A is
    1. 0.50 A
    2. 2.0 A
    3. 1.5 A
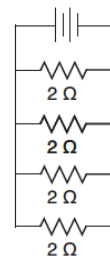   4. 6.0 A

29. If switch S_1 is closed, the equivalent resistance of the circuit is
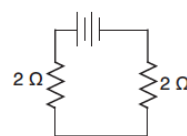   1. 8 ohms
    2. 2 ohms
    3. 3 ohms
    4. 16 ohms

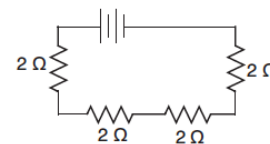30. Which circuit has the smallest equivalent resistance?

    2 Ω
    2 Ω
    (1)

    2 Ω
    2 Ω
    2 Ω
    2 Ω
    (3)

    2 Ω   2 Ω
    (2)

   2 Ω   2 Ω
    2 Ω   2 Ω
    (4)

Circuits-Circuit Analysis

Base your answers to questions 31 through 33 on the information below.

A 5-ohm resistor, a 10-ohm resistor, and a 15-ohm resistor are connected in parallel with a battery. The current through the 5-ohm resistor is 2.4 amperes.

31. Using standard circuit symbols, draw a diagram of this electric circuit. in the space at right.

32. Calculate the amount of electrical energy expended in the 5-ohm resistor in 2 minutes.

33. A 20-ohm resistor is added to the circuit in parallel with the other resistors. Describe the effect the addition of this resistor has on the amount of electrical energy expended in the 5-ohm resistor in 2 minutes.

34. In the circuit diagram below, two 4-ohm resistors are connected to a 16-volt battery as shown.
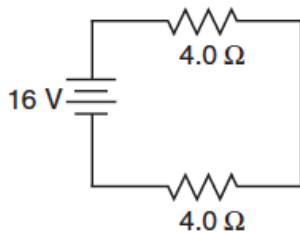

The rate at which electrical energy is expended in this circuit is
1. 8.0 W
2. 16 W
3. 32 W
4. 64 W

35. Two identical resistors connected in series have an equivalent resistance of 4 ohms. The same two resistors, when connected in parallel, have an equivalent resistance of
1. 1 ohm
2. 2 ohms
3. 8 ohms
4. 4 ohms

36. An electric circuit contains a source of potential difference and 5-ohm resistors that combine to give the circuit an equivalent resistance of 15 ohms. In the space below, draw a diagram of this circuit using standard circuit symbols. [Assume the availability of any number of 5-ohm resistors and wires of negligible resistance.]

Circuits-Circuit Analysis

Base your answers to questions 37 through 39 on the diagram below, which represents an electrical circuit consisting of four resistors and a 12-volt battery.
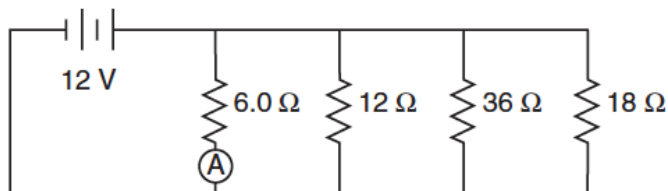
37. What is the current measured by ammeter A?
    1. 0.50 A
    2. 2.0 A
    3. 72 A
    4. 4.0 A

38. What is the equivalent resistance of this circuit?
    1. 72 ohms
    2. 18 ohms
    3. 3.0 ohms
    4. 0.33 ohms

39. How much power is dissipated in the 36-ohm resistor?
    1. 110 W
    2. 48 W
    3. 3.0 W
    4. 4.0 W

40. Three resistors, 4 ohms, 6 ohms, and 8 ohms, are connected in parallel in an electric circuit. The equivalent resistance of the circuit is
    1. less than 4 ohms
    2. between 4 ohms and 8 ohms
    3. between 10 ohms and 18 ohms
    4. 18 ohms

41. A simple circuit consists of a 100-ohm resistor connected to a battery. A 25-ohm resistor is to be connected in the circuit. Determine the smallest equivalent resistance possible when both resistors are connected to the battery.
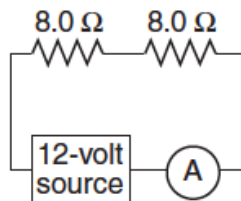
Base your answers to questions 42 through 44 on the information and diagram below.

A 20-ohm resistor and a 30-ohm resistor are connected in parallel to a 12-volt battery as shown. An ammeter is connected as shown.
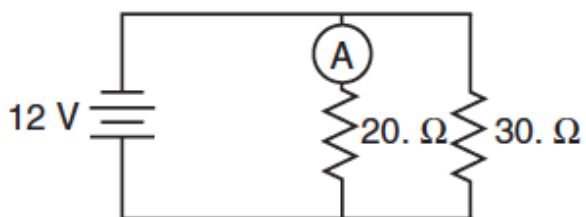
42. What is the equivalent resistance of the circuit?
    1. 10 Ω
    2. 12 Ω
    3. 25 Ω
    4. 50 Ω

43. What is the current reading of the ammeter?
    1. 1.0 A
    2. 0.60 A
    3. 0.40 A
    4. 0.20 A

44. What is the power of the 30-ohm resistor?
    1. 4.8 W
    2. 12 W
    3. 30 W
    4. 75 W

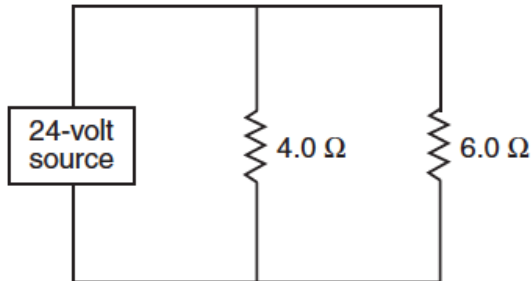45. The diagram below shows a circuit with two resistors.

What is the reading on ammeter A?
    1. 1.3 A
   2. 1.5 A
    3. 3.0 A
    4. 0.75 A

Circuits-Circuit Analysis

Base your answers to questions 46 and 47 on the circuit diagram below, which shows two resistors connected to a 24-volt source of potential difference.

46. On the diagram above, use the appropriate circuit symbol to indicate a correct placement of a voltmeter to determine the potential difference across the circuit.

47. What is the total resistance of the circuit?
    1. 0.42 Ω
   2. 2.4 Ω
    3. 5.0 Ω
    4. 10 Ω

48. The diagram below represents an electric circuit consisting of a 12-volt battery, a 3-ohm resistor, R_1, and a variable resistor, R_2.
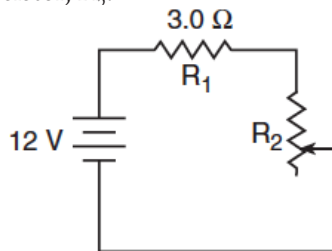

At what value must the variable resistor be set to produce a current of 1.0 ampere through R_1?
    1. 6.0 Ω
    2. 9.0 Ω
    3. 3.0 Ω
    4. 12 Ω

49. Two identical resistors connected in parallel have an equivalent resistance of 40 ohms. What is the resistance of each resistor?
    1. 20 Ω
    2. 40 Ω
    3. 80 Ω
    4. 160 Ω

50. A 6-ohm lamp requires 0.25 ampere of current to operate. In which circuit below would the lamp operate correctly when switch S is closed?
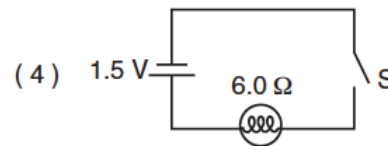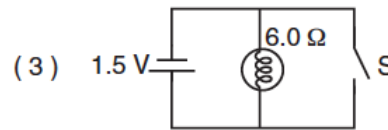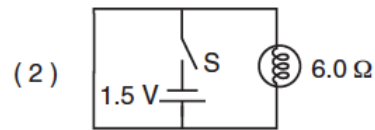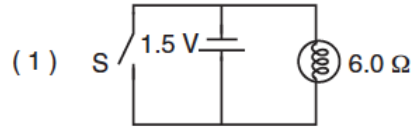
51. In which circuit represented below are meters properly connected to measure the current through resistor R1 and the potential difference across resistor R2?
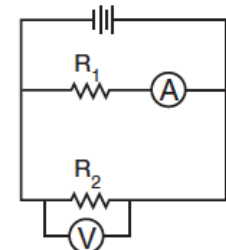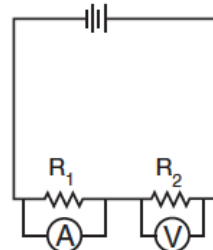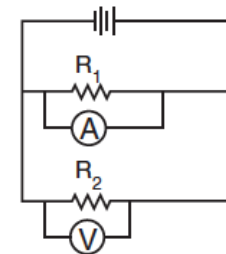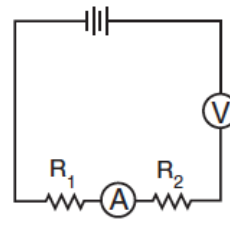
Circuits-Circuit Analysis

52. Which combination of resistors has the smallest equivalent resistance?

(1) —WWW—WWW—
    2 Ω   2 Ω

(2) 2 Ω (top) / 2 Ω (bottom) in parallel

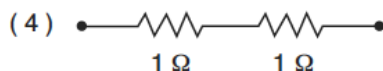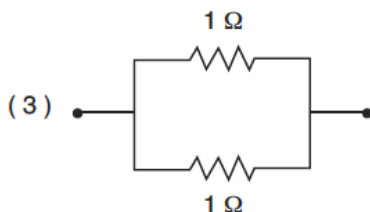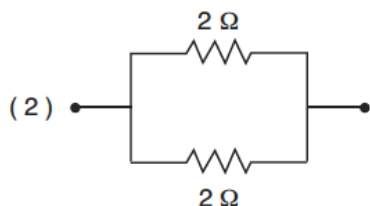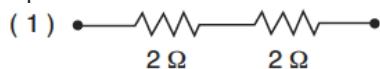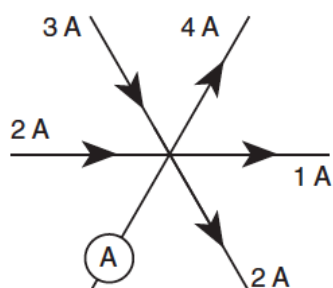(3) 1 Ω (top) / 1 Ω (bottom) in parallel

(4) —WWW—WWW—
    1 Ω   1 Ω

53. The diagram below represents currents in a segment of an electric circuit.

3 A   4 A
2 A
        1 A
   A
        2 A

What is the reading of ammeter A?
1. 1 A
2. 2 A
3. 3 A
4. 4 A

54. What is the minimum equipment needed to determine the power dissipated in a resistor of unknown value?
1. a voltmeter, only
2. an ammeter, only
3. a voltmeter and an ammeter, only
4. a voltmeter, an ammeter, and a stopwatch

55. The diagram below represents a circuit consisting of two resistors connected to a source of potential difference.

10. Ω
120-V source
20. Ω
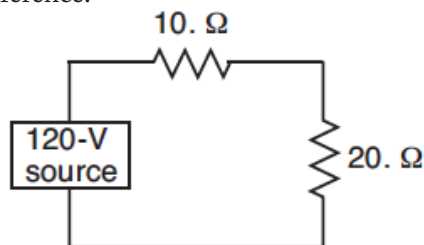
What is the current through the 20-ohm resistor?
1. 0.25 A
2. 6.0 A
3. 12 A
4. 4.0 A

56. In the circuit diagram shown below, ammeter A_1 reads 10 amperes.

10. A
A_1
A_2 A_3
     20. Ω   30. Ω
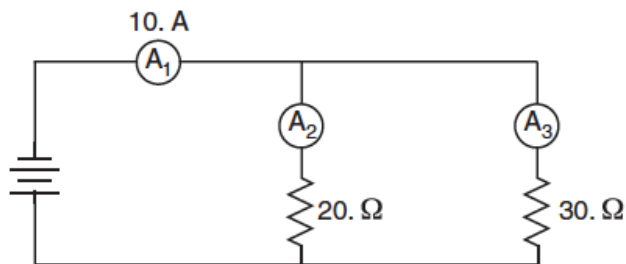
What is the reading of ammeter A_2?
1. 6.0 A
2. 10 A
3. 20 A
4. 4.0 A

57. In the circuit represented by the diagram below, what is the reading of voltmeter V?

V
20. Ω
60.-volt source
10. Ω
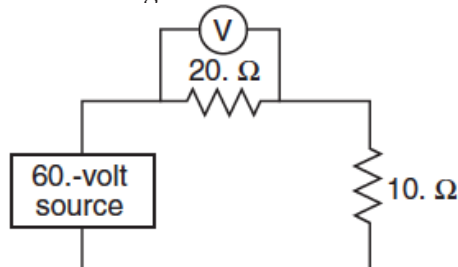
1. 20 V
2. 2.0 V
3. 30 V
4. 40 V

Circuits-Circuit Analysis

58. In the electric circuit diagram below, possible locations of an ammeter and a voltmeter are indicated by circles 1,2, 3, and 4.
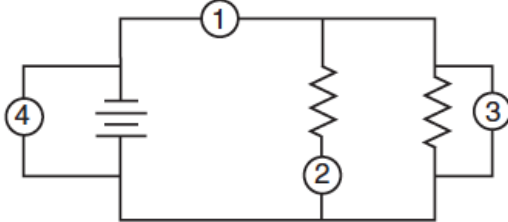
Where should an ammeter be located to correctly measure the total current and where should a voltmeter be located to correctly measure the total voltage?
1. ammeter at 1 and voltmeter at 4
2. ammeter at 2 and voltmeter at 3
3. ammeter at 3 and voltmeter at 4
4. ammeter at 1 and voltmeter at 2

59. What must be inserted between points A and B to establish a steady electric current in the incomplete circuit represented in the diagram below?
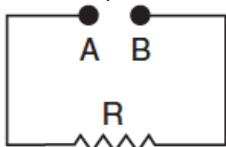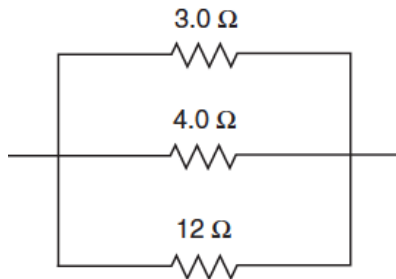
1. switch
2. voltmeter
3. magnetic field source
4. source of potential difference

60. The diagram below represents part of an electric circuit containing three resistors.

What is the equivalent resistance of this part of the circuit?
1. 0.67 Ω
2. 1.5 Ω
3. 6.3 Ω
4. 19 Ω

61. The diagram below represents a simple circuit consisting of a variable resistor, a battery, an ammeter, and a voltmeter
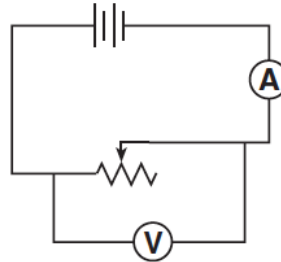
What is the effect of increasing the resistance of the variable resistor from 1000 Ω to 10000 Ω? [Assume constant temperature.]
1. The ammeter reading decreases.
2. The ammeter reading increases.
3. The voltmeter reading decreases.
4. The voltmeter reading increases.

62. Three identical lamps are connected in parallel with each other. If the resistance of each lamp is X ohms, what is the equivalent resistance of this parallel combination?
1. X Ω
2. X/3 Ω
3. 3X Ω
4. 3/X Ω

63. A 3-ohm resistor and a 6-ohm resistor are connected in series in an operating electric circuit. If the current through the 3-ohm resistor is 4 amperes, what is the potential difference across the 6-ohm resistor?
1. 8.0 V
2. 2.0 V
3. 12 V
4. 24 V

64. Circuit A has four 3-ohm resistors connected in series with a 24-volt battery, and circuit B has two 3-ohm resistors connected in series with a 24-volt battery. Compared to the total potential drop across circuit A, the total potential drop across circuit B is
1. one-half as great
2. twice as great
3. the same
4. four times as great

Circuits-Circuit Analysis

65. A circuit consists of a 10-ohm resistor, a 15-ohm resistor, and a 20-ohm resistor connected in parallel across a 9-volt battery. What is the equivalent resistance of this circuit?
    1. 0.200 Ω
    2. 1.95 Ω
    3. 4.62 Ω
    4. 45.0 Ω

66. A 2-ohm resistor and a 4-ohm resistor are connected in series with a 12-volt battery. If the current through the 2-ohm resistor is 2.0 amperes, the current through the 4-ohm resistor is
    1. 1.0 A
    2. 2.0 A
    3. 3.0 A
    4. 4.0 A

67. A 3-ohm resistor and a 6-ohm resistor are connected in parallel across a 9-volt battery. Which statement best compares the potential difference across each resistor?
    1. The potential difference across the 6-ohm resistor is the same as the potential difference across the 3-ohm resistor.
    2. The potential difference across the 6-ohm resistor is twice as great as the potential difference across the 3-ohm resistor.
    3. The potential difference across the 6-ohm resistor is half as great as the potential difference across the 3-ohm resistor.
    4. The potential difference across the 6-ohm resistor is four times as great as the potential difference across the 3-ohm resistor.

68. A 3.6-volt battery is used to operate a cell phone for 5 minutes. If the cell phone dissipates 0.064 watt of power during its operation, current that passes through the phone is
    1. 0.018 A
    2. 5.3 A
    3. 19 A
    4. 56 A

69. To increase the brightness of a desk lamp, a student replaces a 50-watt incandescent lightbulb with a 100-watt incandescent lightbulb. Compared to the 50-watt lightbulb, the 100-watt lightbulb has
    1. less resistance and draws more current
    2. less resistance and draws less current
    3. more resistance and draws more current
    4. more resistance and draws less current

Base your answers to questions 70 and 71 on the information below.

A 15-ohm resistor and a 20-ohm resistor are connected in parallel with a 9-volt battery. A single ammeter is connected to measure the total current of the circuit.

70. Draw a diagram of this circuit using standard circuit schematic symbols.

71. Calculate the equivalent resistance of the circuit. [Show all work including the equation and substitution with units.]

Circuits-Circuit Analysis

72. The diagram below shows currents in a segment of an electric circuit.
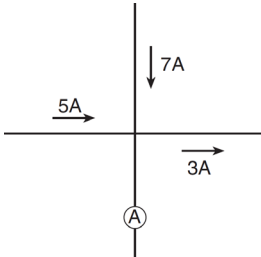
What is the reading of ammeter A?
1. 1 A
2. 5 A
3. 9 A
4. 15 A

Base your answers to questions 73 and 74 on the information below.

A 20-ohm resistor, R_1, and a resistor of unknown resistance, R_2, are connected in parallel to a 30-volt source, as shown in the circuit diagram below. An ammeter in the circuit reads 2.0 amperes.
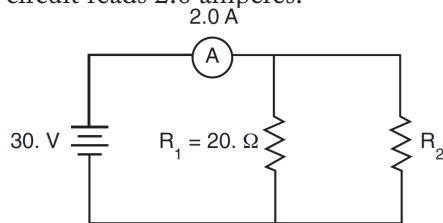
73. Determine the equivalent resistance of the circuit.

74. Calculate the resistance of resistor R_2. [Show all work including the equation and substitution with units.]

Base your answers to questions 75 through 78 on the information below.

A student constructed a series circuit consisting of a 12.0-volt battery, a 10.0-ohm lamp, and a resistor. The circuit does not contain a voltmeter or an ammeter. When the circuit is operating, the total current through the circuit is 0.50 ampere.

75. In the space below, draw a diagram of the series circuit constructed to operate the lamp, using symbols from the Reference Tables for Physical Setting/Physics.

76. Determine the equivalent resistance of the circuit.

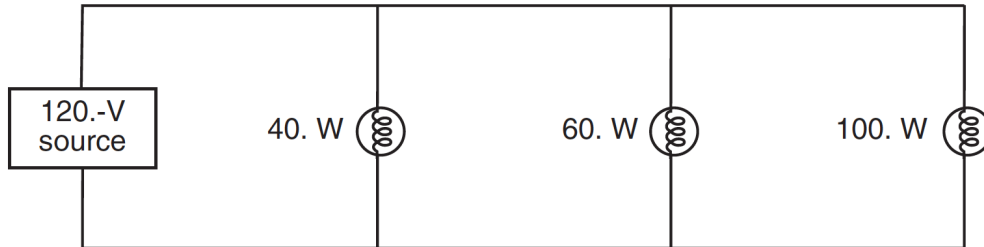77. Determine the resistance of the resistor.

78. Calculate the power consumed by the lamp.

79. If several resistors are connected in series in an electric circuit, the potential difference across each resistor
1. varies directly with its resistance
2. varies inversely with its resistance
3. varies inversely with the square of its resistance
4. is independent of its resistance

Circuits-Circuit Analysis

Base your answers to questions 80 through 83 on the information and circuit diagram below and on your knowledge of physics. Three lamps are connected in parallel to a 120-volt source of potential difference, as represented below.

80. Calculate the resistance of the 40-watt lamp. [Show all work, including the equation, substitution with units, and answer with units.]

81. Describe what change, if any, would occur in the power dissipated by the 100-watt lamp if the 60-watt lamp were to burn out.

82. Describe what change, if any, would occur in the equivalent resistance of the circuit if the 60-watt lamp were to burn out.

83. The circuit is disassembled. The same three lamps are then connected in series with each other and the source. Compare the equivalent resistance of this series circuit to the equivalent resistance of the parallel circuit.